Abstract of the Disclosure

There are provided low expansion transparent glass-ceramics obtained by heat treating a base glass produced at a relatively low melting temperature of 1530℃ or below. The glass-ceramics have an average linear thermal expansion coefficient within a range from $+6\times10^{-7}$/℃ to $+35\times10^{-7}$/℃, 80% transmittance wavelength ($T_{80}$) of 700nm or below. internal transmittance of 75% or over at light wavelength of 1550nm, heat resisting temperature of 800℃ or over and Young's modulus of 90 GPa or over. The glass-ceramics comprise $SiO_2$, $Al_2O_3$, MgO, CaO, BaO, ZnO, $Li_2O$, $TiO_2$ and $ZrO_2$ and contain $\beta$-quartz or $\beta$-quartz solid solution as a predominant crystal phase. There are also provided optical waveguide elements and an arrayed waveguide grating (AWG) type planar lightwave circuit utilizing these glass-ceramics.